WIRE
& WIRE PRODUCTS

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By A. E. Bellis

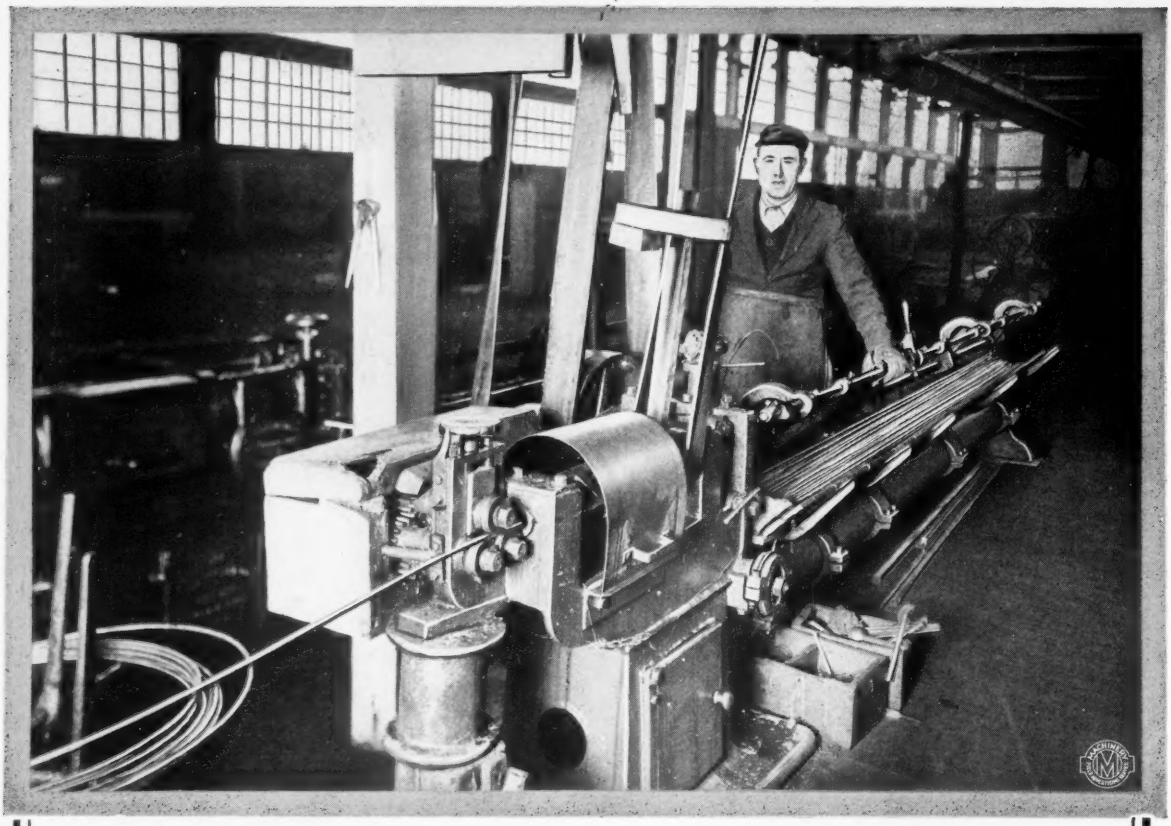
Pin Manufacture in Europe
By H. Kolip

Heat Treatment of Spring and Music Wire

An Eight-Mile, Three-Strand Cable

News

November 1926



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SAY—said a friendly critic, fresh from the Connecticut wiredom—you fellows are beating the European drum pretty hard. What about the American developments?

And so we explained to him that observation, unlike charity, need not begin at home; and that by offering information on manufacturing methods in relatively inaccessible localities we are doing valuable service to the home industry.

* * *

Speaking of the home industry—meaning the wire industry, of course—it should feel complimented by the attention it is receiving abroad. Hardly a week passes without some inquiries being received at our office from European firms. They either ask concerning details on American practice, or as to who manufactures this or that or more briefly and pertinently send us a check for subscriptions.

* * *

There are only three journals in the world devoted exclusively to the wire industry. Wire and Wire Products is one of them; the other two are both German publications. One of these is in its thirty-fifth year and yet our magazine is comparable with them in circulation.

* * *

Meanwhile our friends in the American plants drop in every so often to ask us how it is that nobody thought of creating a magazine for the wire industry before us. And we confess our inability to explain and modestly mumble something about a live Wire journal . . .

* * *

Incidentally, laying modesty aside, we are pleased to announce that Wire & Wire Products has completed the first half year of its existence with double the initial advertisements and three times its initial circulation!

The Publishers.

WIRE & WIRE PRODUCTS

A monthly publication devoted to wire drawing and wire forming

Vol. 1 November, 1926 No. 7

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Editorial Offices:
471 Fourth Ave., New York City, Tel., Ashland 0568
Publication Office, Washington, N. J.
Issued Monthly
50c a Copy
Subscription Price U. S. $5.00
Foreign $7.50 per year

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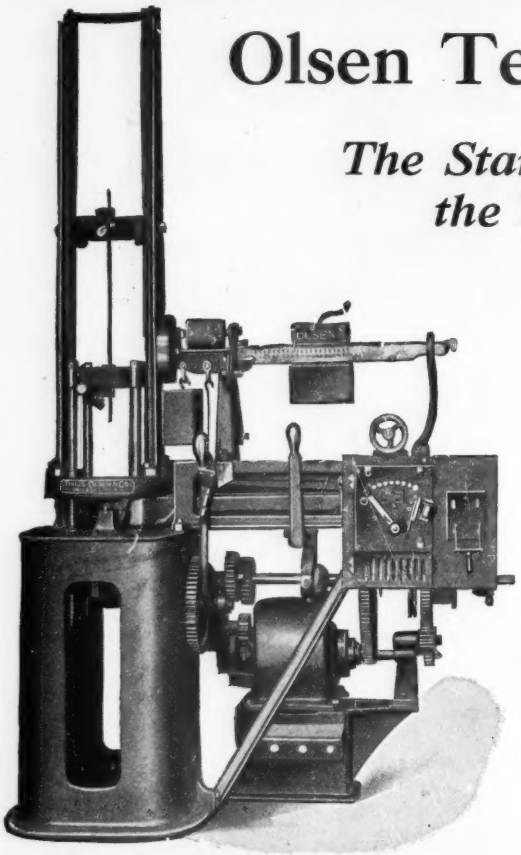

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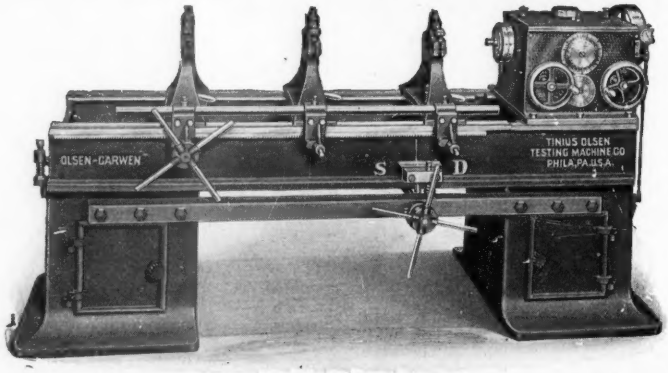

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WIRE & WIRE PRODUCTS

Vol. I NOVEMBER, 1926 No. 7

Annealing Wire in Salt Baths

The characteristics of Liquid salt baths in heat treatment of wire

By A. E. Bellis

DR. ALTPETER concludes article on manufacture of wire in the August number of Wire and Wire Products with the statement that annealing is the cause of most of the difficulties met with in the production of iron and steel wire, explaining how the drawing of the wire, the life of the dies and the properties of the wire suffer from uneven heating in the annealing processes. A method of overcoming these difficulties, based on the use of a liquid heating medium has recently been developed, and is the subject of this paper.

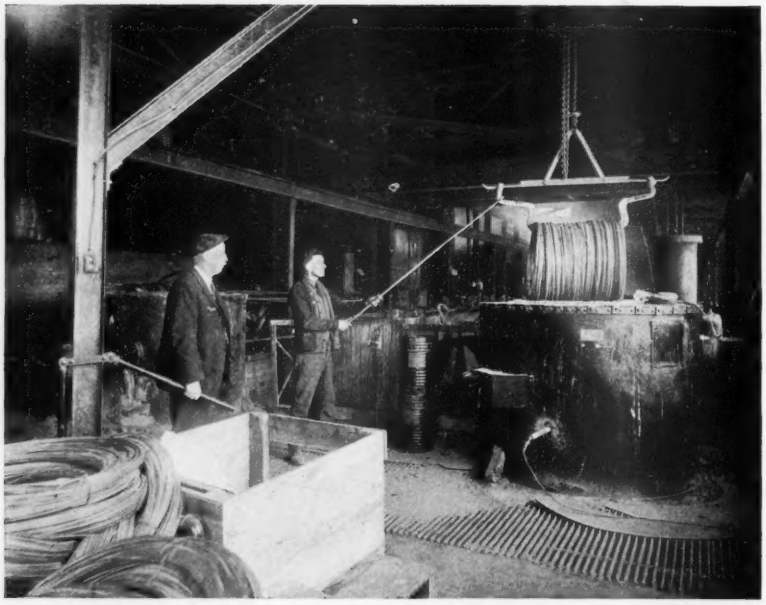
The application of a liquid heating medium to the problem of quantity production wire annealing was not undertaken until the problems of using such a medium for small scale operations, such as tool hardening work, had been satisfactorily solved, and only when it had been clearly demonstrated that a bath could be made that was neutral to steel, capable of continuous use at high temperatures without deterioration of any kind, and free from all rusting troubls and the deficiencies of cyanides, barium chloride and lead baths.

Non-uniform Heating

In retrospect it is very interesting to find that the difficulties that Dr. Altpeter mentions as being the wire man's chief problem are exactly the ones that originally led to the development of a proper liquid heating medium for the precise heat treatment of fine tools. When the old blacksmiths skilled eye was replaced by pyrometers there was one factor that was not mechanically controlled and that was the uniformity, or equilibrium of heating of the work. Most failures in tool hardening can be attributed to lack of uniformity of heating, either in parts of the same piece, or of the furnace, or to irregular rates of heating, or again to irregular treatment from piece to piece. While the modern pyrometer itself is dependable enough for accurate work, the obtaining of equilibrium between the thermal junction temperature and the work being treated is the real problem. Those doing the work sometimes fully appreciate the fact of the possible difference in heat conditions of the fire end of the thermocouple and the work, but in a discouraging number of instances no real appreciation is shown of the temperature lag of the work and pyrometer or difference in rates of heating of the various parts of the system. Sometimes even the fire ends are kept away from the hot parts of the oven "so they won't burn out so fast" with disastrous results to the work. This point is dwelt on because some remarkable developments have resulted in annealing practice. Exact temperatures, that is equilibrium conditions in the work being heated, become possible when a liquid is used as the heating medium. In contrasting a bath with an oven, including ovens electrically heated, an element of uncertainty arises where the heat conducting medium is air or gas, necessitating heating above the temperature of the steel to be heated. Some specific illustrations of the importance of getting a definite uniform annealing temperature will be given in describing particular annealing installations.

Rate of Heating Not Essential

In general it may be stated that the most remarkable metallurgical result from experience



Removing a charge from the salt annealing bath in the Atlantic Wire Co., plant.

with the bath annealing methods is the recognition that the essential factor in annealing is the temperature reached by the material and not the time at temperature, nor rate of heating, nor rate of cooling. This radical conclusion has been questioned many times, but repeated tests have demonstrated it by means of the precise temperature consistently attainable from the bath or liquid heating method.

Early Failures in Salt Baths

As stated above, the mechanical problems of an annealing bath were not solved until the properties of a satisfactory bath material had been discovered. As is well known, ordinary salt baths have been failures in general heat treating applications as well as in attempts to anneal wire and had obvious limitations. One of the largest wire companies has suffered enormous losses from the troubles resulting from trying to use salt as a lubricant years ago, and a later attempt in the same plant to use a salt bath for annealing had been disastrous. Due to the improper and unstable character of the bath material the wire and pots were badly attacked and corroded. The wire trade was therefore decidedly prejudiced against any salt bath process, as these failures had been known and much discussed. There resulted a particular antipathy to any salt baths in wire mills. In the hardening or heat treating field, up to eight years ago, similar conditions prevailed. Here the opposition to salt baths was largely due to the failure of the large tool manufacturers to get properly hardened tools in this way and from the failure of a large electric furnace maker to develop the barium chloride bath. After numerous and costly failures it was the general opinion among steel treaters that salt baths were good things to keep away from.

The difficulties from the old salt baths were specific ones, and it was possible to develop baths that overcame the limitations that had led to this pessimistic state of affairs. Patented baths are now available and are sold under a trade name. They have of the following characteristics:

1. Non-hygroscopic (do not cause rusting).
2. Have ideal heat transference characteristics.
3. Do not deteriorate with use.
4. Are chemically neutral to metals.
5. Can be used through 1,000° temperature range.

Effective Salt Baths

Looked at from the chemical and physical standpoint it is remarkable that there occurr in nature, materials that can be fused to give these characteristics. Water which is ordinarily considered as the most efficient heat transfer medium has a range of only 180° F., from 32 to 212°. At the upper part of this range water volatilizes rapidly. The heat treating baths referred to have over five times the temperature range, do not evaporate at all, and are neutral to steel through this wide range. Such baths have been successful in solving many intricate heat treating problems including hardening the fine automotive and high speed steels.

Baths having the above characteristics can be used year in and year out without replacing the bath material except for the film carried off on the work. In the case of wire annealing, or wherever the economy of operation requires it, even the material carried off can be recovered by solution and evaporation.

With the proper salt-bath material available the details of handling wire annealing practice was worked out successfully and plants have been in continuous operation for about two years and the number of materials handled is rapidly increasing. The general plan of handling is shown in the accompanying photographs and layout sketches. It can best be described from details of one typical installation. Very conservative figures are given making allowances for the usual shop conditions.

A Typical Installation

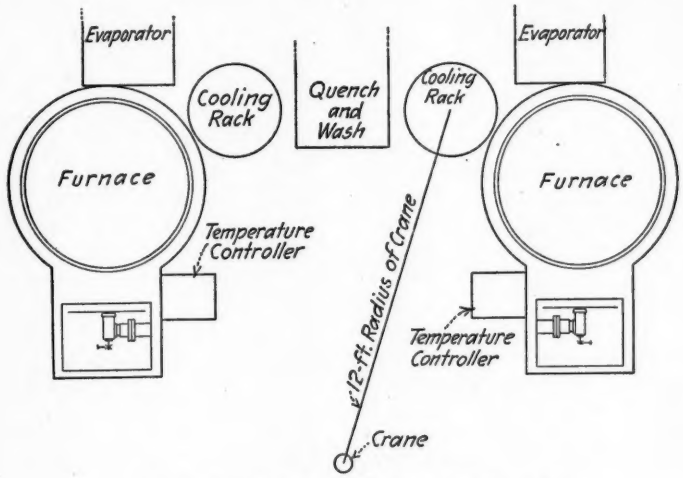
The work, low carbon wire gauges 0 to 19 is delivered to the annealing in coils weighing 150 to 250 lbs. These are suspended on yokes two or three at a time, making charges of 300 to 500 lbs. A quick acting elec-

tric hoist on a jib crane delivers the work to the bath, maintained at 1275 to 1300° F. in the furnace. It is left there for fifteen minutes. The furnace temperature drops 10 or 20° when the load is added, but recovers during the next ten minutes. The wire is removed and allowed to drain on a rack for fifteen minutes while the next load is being heated. After draining, the wire, which has cooled below 500° F., is quenched or washed in water which becomes a solution of the bath material. It has been found that this cooling period is relatively unimportant and frequently a direct quench gives a satisfactory anneal. It is the established practice with some grades of material. This fact has been the sourec of much controversy and points to the conclusion that the essential factor in most annealing operations is the annealing temperature rather than the rate of cooling. After the heating the wire is uniformly the dull red color characteristic of the temperature. Due to the short duration of the heating cycle, there is no excessive grain growth. No single strand gets overheated as there is no temperature gradient necessary for quick heating, as is the case in any oven method. An observation of the coils as they are removed from the bath is much more convincing on these points than any description can be. After the quenching or washing the coils are rinsed in clean water to remove the solution and then are ready for the lime coating or liquor according to the further processing.

Economy of the Process

The details of the arrangements of the units to efficiently operate one, two or four units is shown in the sketches. In the single unit plan one man can operate the furnace and handle the loading and washing. With the two furnace unit, two men can handle these operations and in the four furnace unit, three men are needed.

Wire drawn down to 20 gauge is now annealed by this method, special yokes being required for the finer sizes. Strip up to 2 inches wide is now handled on a production basis on the same plan as the round wire is handled, but wider strip has to be handled in a different manner. An interesting practical advantage of the process on the chrome-containing alloys is that pickling of the hot rods is much more easily accomplished after they have been through this anneal, as the method acts to wash off the scale instead of adding to it. In some cases the pickling can be eliminated altogether.



Layout of equipment for two salt bath annealing units.

An important factor in the economy of the process as applied to production annealing is the recovery of the bath material from the quenching solution. This is carried out by evaporation with the exhaust heat from the furnace vents and is practically automatic. The operator allows enough solution to evaporate each day to make up for the quantity mechanically carried off from the "wetting" of the coils.. It is this thin protective "watery" coating that prevents any scaling of the wire in the cooling cycle so that the surface of the wire is unchanged from the annealing process, to the great advantage of the further working or drawing operations. This feature of recovery evaporating has been worked out so as to give an easily operated and controlled relationship between the cycles of wire annealing and recovery requiring practically no extra labor and using only heat that would otherwise go to the stack.

The other details of the furnace have been worked out to give a proper heat balance between the work going into the furnace and the volume of the baths. A uniform combustion chamber temperature is essential for satisfactory pot life and is obtained by using pyrometric temperature control. A steel pot lasts six or eights weeks continuous operating and is discarded before failure.

Experiments on Salt Baths

The results briefly mentioned in the foregoing paragraphs were not easily or quickly obtained, but are results of long and costly experience. They are results, however, that are predictable in future duplications or modifications of the method and have all been proven in at least three separate organizations. The development of the proper bath material for example, was the result of thousands of tests made after a thorough study of the literature and prior art. The success of the furnace was the result of testing ideas of the supposed authorities on furnace building and then try-

(*Continued on page 245*)

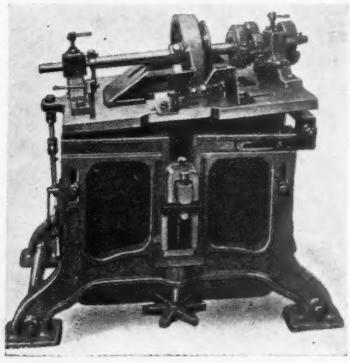
Pin Manufacture in Europe

The development of pin manufacture and some recent improvements in the machine operations

By H. Kolip

Engineer to M. A. Irmischer

The report that, on account of the so-called Anti-Dumping Law, additional duties will be levied on German made straight pins and safety pins because the selling price of these pins is—according to the judgment of the American pin industry—lower than the manufacturing cost,



A type of pointing machine.

certainly attracts the attention of that industry to the European method of the manufacture of pins and therefore I was induced to write at this place about the manufacture of pins on the continent.

Early Stages

In Germany the first metal pins were made at Aachen (Aix-la-Chapelle) and Nuremberg where the pin industry was established in the "Guilds." Before that time fish bone or ordinary bone pins and wooden pins were used. The first metal pins however came more and more into general use and on such a large scale that since the middle ages special methods were developed for the mass production of pins. These pins were made by hand of course at the beginning and only brass wire was used because until the end of the 18th century the prick of the iron pin was considered poisonous.

Two kinds of brass wire were used for the pins; a thick and hard grade for the shafts and a softer grade for the heads. The wire for the shaft was cut after being made hard and stiff by a drawing process without annealing. This wire was straightened by drawing through two rows of from 5 to 7 iron bolts mounted on a so-called straightening board. By means of special shears provided with a semi-cylindrical trough the wire was usually cut into pieces of twice the length of the pins. The rate of out-put was about 3000 to 5,000 shafts per hour.

Then the brass shafts were ground by means of a steel ring of 3 to 5 inches diameter and about 2 inches wide, provided with a file surface on the outer side. The laborer held from 20 to 40 shafts in his left hand so that they were in line between his fingers. During the grinding he revolved the shafts by means of his thumb. In this way about 3500 shafts could be pointed at both ends per hour. Usually two grinding rings were used the first with a rough filing surface to point the pins and the second with a fine surface for finishing and polishing. Then the pins were cut into their proper length by means of hand shears.

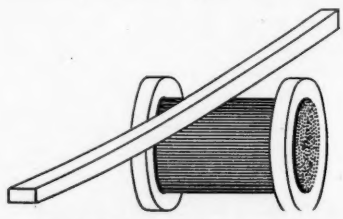
Pin Heads

The wire used for the heads was thinner and well annealed. Of this wire a coil was wound around another brass wire 25 to 35 inches long, the latter having a diameter equal to that of the pin shaft. A skilled laborer could "spin" within one hour enough wire for about 35,000 pin heads. Five of these small coils were cut simultaneously with the hand shears into the small pieces which were used for the head; each piece consisted of exactly two turns of the wire. This work required exceptional skill and experience in order to prevent differences in shape and size of the head. A skilled laborer was able to cut from 30,000 to 40,000 heads per hour. These turns were then annealed and treated with diluted sulphuric acid by which process the bright finish was obtained.

The heads were fastened to the shafts by means of a special device. The laborer picked up a head with the point of the shaft and let it slide to the end of the latter. Then he revolved this end in the spherical dimple of the lower die of a wedging machine, while the top die operated by a pedal, swedged the head onto the shaft. The operation required some 4 to 7 blows. One man was able to provide about 1000 to 1200 pins per hour with heads. While stamping one head he could pick up another head with the other hand. This hand-manufacture can still be found today. The brass shafts however have been replaced by steel ones.

Iron Pins

At the beginning of the 19th century the manufacture of iron



Straightening the shafts for pins.

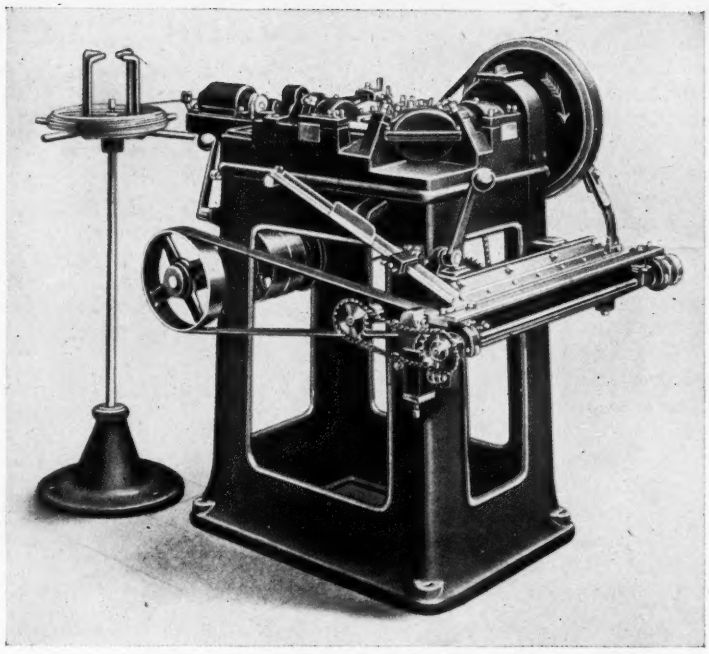
pins was started which due to the improving of iron mines became a serious competitor of the brass pins. The iron however required a different straightening process. The pin shafts were put between two rings heated in an annealing furnace and worked with a straightening iron until they were straightened. Then they were hardened in oil and after being cut in the middle their ends which were to carry the heads were softened. This was done by putting the shafts into the grooves of a disk so that the ends provided for the heads passed through a gas burner as the disk revolved. This annealing process gave the pins a bluish color. After finishing the pins the familiar light color was obtained by a treatment with diluted sulphuric acid, subsquent water wash, and by polishing in revolving drums filled with the saw-dust of beach-wood.

Mention should be made of a few processes of manufacturing pins with cast heads, which were known at the time.

For a long time in the history of needle manufacture the head and the finished pin shaft were separately made and united by a swedging operation. Special machines then appeared on the market which made the heads by up-setting. The shafts however were still separately made and were then put in a feed box of the so called head up-setting machine. The manufacturing cost of those pins is very high and they are made only nowadays on the request of customers who prefer this kind of pins because of the unusually fine point.

Recent Developments

A further progress toward the economical manufacture of pins is represented by the construction of universal pin machines which turn out finished pins from the wire coil. Recent improvements led to the development of a high out-pin machine which might be considered the most perfect machine built up to the present time. In this new machine an entirely new process is used for the up-setting of the heads.



A German pin making machine, which turns out finished pins from the wire coil.

It is known that the head of a pin cannot be made by a single blow. The wire end required for the head and protruding from the jaws of the machine would be too long and would bend under a single blow of the die rather than form a round and symmetrical head. In the previous machines the head was therefore formed by three blows in such a way that after the first and second blow additional wire was fed in order to complete the head. The pins were therefore made by first feeding a length of wire sufficient for the shaft plus 1-3 of the material for the head. Then in two consecutive steps additional thirds of the head material were fed. At each process the jaws which held the material had to open and close properly.

This principle of a three process head up-setting could not, of course, be eliminated in the new machine. But in the previous machine the wire feeding device for the forming of the pin-shaft and the head had to make three movements which were necessitated by the feeding cam, and thereby much time was lost and the out-put of the machine was limited because the reverse movement of the wire feeding device could start only after completion of the head. The inertia of the feed-fork and the wire-catch lever were also of unfavorable influence in this respect. Therefore the out-put could hardly exceed 150 pins per minute especially for long pins. This loss of time involved in the previous machine has been eliminated in the new machine by means of a spherical process for up-setting heads. This process permits feeding at once the whole length of wire required for the shaft and for the entire head, without abandoning the "repeated-blow" method which is the only means of obtaining a neat and fully equipped head. While all the material required for the shaft and the head is fed at once, the feeding device moves back during the pressing of the head. This gain in time together with the simplification of the working operation permits a considerable increase in the speed of the machine. The feeding mechanism has been

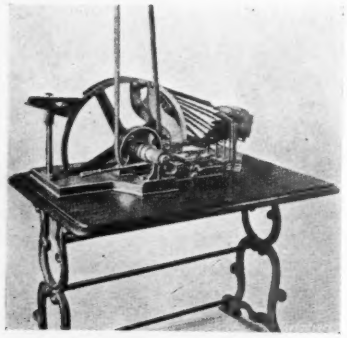
simplified in such a way as to eliminate the bulky parts of the feeding fork and the wire-catch lever and thereby the undesirable inertia effects, which would have become even more unfavorable at the increased speed, were overcome. The high speed requires an effective lubrication and therefore the cams are placed in closed oil baths thus insuring continuous automatic lubrication.

The wire is straightened by means of a revolving straightening mechanism which is attached to the machine and is driven by a rope-pulley from the main shaft of the machine.

The grinding shaft runs in ball-bearings and is considerably longer than in the old type machine thus insuring excellent points at the very highest speed. The pointing device is operated by a chain drive from the main shaft. By a change of the grinding shaft it is possible to make with the same machine either iron, steel or brass pins.

Four or six machines of this type can be operated without difficulty by one operator with the assistance of a boy. Its output is about 450 steel or iron pins per minute or 500 brass pins.

The forming operations are the most important factors in determining the quality of the product and has therefore been described at length in this place. The finishing operation will be mentioned but briefly, because these differ considerably in various plants.



A needle sorting machine of English make.

(*Continued on page 247*)

"Round Stone" Diamond Dies

By A. Simon

President, Union Wire Die Co.

During the past sixty years, diamond dies have been manufactured for the production of all sorts and hardnesses of wire. It has been the custom of die manufacturers to use a so-called flat diamond, or in other words, a cleaved stone for the following three reasons:

1. The flat stone is thin and consequently requires less drilling.
2. The flat stone is easier to drill because it is cleaved with the grain.
3. The flat stone presents more surface in finding a clear spot for the hole.

In consequence of the above reasons, the cost of producing a diamond out of a flat stone is much lower, and therefore the flat stone was adopted.

In the course of time, it also became the opinion of diamond die makers that a diamond die could only be made out of a flat stone, because a round stone presented too long a bearing to pierce and in addition to that, required the flattening on both sides so as to be able to start the drilling.

The Union Wire Die Corporation was the first one to begin to use a round stone. While the round, solid, natural stone presented more of a problem for drilling, it made a die that takes a better polish and a much longer entrance, consequently improving the lubrication on the die as well as making a much harder die producing a more polished wire.

Carbon dies with a cost of three to four times as much as a diamond die were used in the production of hard wire before, but diamond dies produced from round, natural stones have taken their place. A die made from a round stone originally cost more than a die from a flat stone, particularly when small dies are considered, but its life and performance offsets the original cost. "The amount of work properly and profitably done determines the *real value* of any article."

Only through the development of special types of machinery and the patenting of a special setting was it possible to solve the problem of drilling the round stone. This has finally cut down the cost to the same level, if not a lower one than that of dies made of flat stones.

Comparative tests with any make die on the same wire have proven production between 30% to 60% more wire on the dies made of round stones, in comparison with those made of flat stones.

As mentioned heretofore a great deal in the accomplishment has depended upon the re-enforced setting the round stone has been given. Without this setting which has been patented, no drilling would be possible, even with the especially adapted types of machinery. In a later article the setting will be discussed in further detail.

Rust Proofing

A new rust profing mixture for iron wires has recently been patented. The inventor has discovered that a substantial and uniform coating of iron phosphate can be produced on iron and steel by the application of an ad-mixture of phosphoric acid and a flotation oil, such as turpentine or pine oil. The proportions of the ingredients may be varied to a great extent but the following formula will be found to produce satisfactory results:

Pine oil 40 gallons, phosphoric acid .6 pound.

A mixture of lower viscosity results from the formula:

Pine oil 40 gallons, phosphoric acid .6 pound, butyl alcohol 5 gallons.

(U. S. Patent 1,592,102)

Eight-Mile Three-Strand Cable

The second cable made by American Steel and Wire Co., to span eight-mile stretch of ocean across San Francisco Bay

THE electric cable works of the American Steel & Wire Co. of Worcester Mass., has made a three-conductor submarine electric cable which will connect San Francisco with Richmond, a distance of eight miles across the bay. It has taken eight gondola cars to transport, each with a one-mile section.

The gondola cars each containing a full mile length of the cable: the entire cable weighs 410 tons.

Some idea of the immensity of the cable may be had from the fact that its diameter is 4¼ inches, it weight 19 pounds per foot and its total weight 410 tons, in it will be 105 tons of copper wire, 88 tons of rubber, 11 tons of tape, 34 tons of jute and 177 tons of armor. It is a duplicate of a cable that the cable works manufactured and laid for the California company in 1922 which is now conveying current under the water of the bay. The laying of the new cable will be under the direction of American Steel & Wire Co. engineers.

The size of each of the three copper conductors of the cable to be laid in the ocean is 500,000 circular mils, having a diameter of more than eight-tenths of an inch, and the size of the shore or trench cable, to be used to connect the submarine cable to the power stations is 750,000 circular mils, or aproximately one inch.

Each of the three conductors composing the finished cable is insulated with 12-32s of an inch of rubber compound containing a high percentage of pure up-river Para rubber, over which is wound a rubber filled tape. These individual conductors, after vulcanization of the rubber compound, are placed in a tank of water for at least 24 hours and then are subjected to an electrical proof test of 30,000 volts for five minutes.

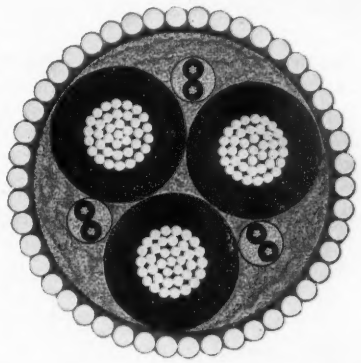
On completion of the electrical tests, which, in addition to the foregoing, are the measurements of the resistance and capacitance characteristic of the dielectric rubber compound, the conductors are loaded onto a cable-stranding machine and assembled into a triple conductor cable for three-phase operation.

In the interstices or valleys the conductors are laid three pairs of telephone wire and jute fillers. These wires have a high grade rubber covering of insulalation, and, before forming a part of the complete cable, are tested in water, after 24 hours' emersion, at 5000 volts, for five minutes' duration. Over the as-assembled cable is wound a rubber-filled tape, to hold the integral parts in proper shape.

The next process is the application of a tarred jute. This acts as a cushion for the 45 galvanized steel wires which are placed around it, as necessary protection for a cable of this construction and final location.

Each section of cable, before being armored, is a quarter of a mile in length, aud four of these sections are joined together behind the armoring machine, making a total of one mile of cable per car into which the finished cable is coiled. Experienced cable jointers make the joints, all of which are electrically tested after completion.

The gondola cars containing the full mile lengths are filled with water, and after the cable has been immersed for 24 hours, it receives final electrical tests and is then prepared for shipment across the continent.



A cross section of the cable, 4¼ in. diameter. The insulation around the main conductors is a rubber compound containing a high percentage of pure Para rubber. Three pairs of telephone wires are layed in the interstices

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Iron and Steel Institute Abandons National Restrictions

Many British scientific and technical societies erased from their rolls the names of all members of German and Austrian nationality. The Iron and Steel Institute has shown its desire to reestablish international amity by recently removing these national restrictions in membership. It has recently reelected Dr. Emil Schrodter as honorary member.

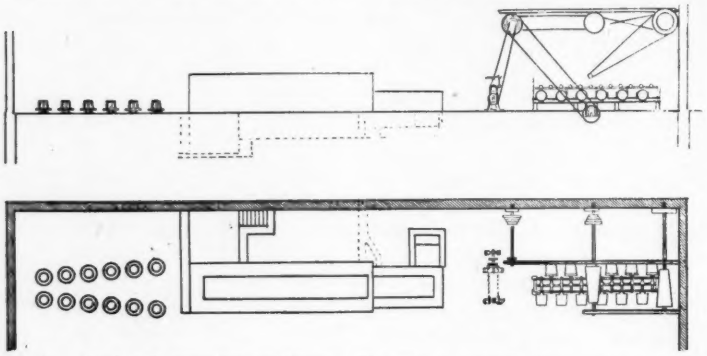
The Manufacture of Iron and Steel Wire in Germany

The heat treatment of spring and music wire

By H. Altpeter

(Translated from Stahl & Eisen, by Carl Marx)

THUS far the various methods used for the annealing of wire have been discussed in a general way, with especial attention to the effects of the heat-treatment on the structure of the finished wire. The present installment of this series of articles take up the details of specific treatments for such wires as are used for special purposes; such as music-wire and spring-wire.



Layout for a lead bath annealing equipment. The wire is unwound from reels on the left, passes through the annealing bath and is wound onto blocks at the right.

It is customary to have on hand a stock of steel rods from 5 to 5.5 mm. thickness from which to select the particular grade most suitable for a given purpose. The carbon-content of this material will lie between 0.15 and 1.00%. High-carbon material can be turned out with less number of drafts after patenting or cementation, quickly yielding a product of high-tenile strength, the cost however, being much greater than with a material lower in carbon-content. Steel wire for cables of the ordinary quality, with a tensile strength of from 130 to 140 kilograms, requires a stock having a carbon-content of about 0.6%C. These wires can be drawn from patented wire in from two to three drafts.

The use of a greather number of drafts will increase the strength, but at the expense of the elongation, and resistance to bending and torsional strains. It is evident that if steel wire containing less carbon than this is used, a greater number of drafts must be made to gain the same strength, remembering that this will have the effect just mentioned. A change in the temperature of the lead bath in the heat-treatment of the wire makes it possible to vary somewhat the stiffness of the wire; a hotter bath yielding softer, and a cooler bath a stiffer wire. The temperature of the lead bath in this case varies from 430 to 500°C, but the optimum temperature isusually determined for the given grade of wire by actual experiment.

After the proper selection of the rolled rod stock has been made, the rods are pickled and dried, following which they are given a few preliminary drafts to bring them down to a certain size, depending upon what is to be manufactured. They are then either given a cementation treatment and then drawn down further, for a final patenting and the finishing drafts, if small sizes are wanted; or immediately patented after the preliminary draft followed directly by the final draft.

As the heat-treatment of wire is rather expensiive, cheaper grades of wire are quite usually drawn down to preliminary sizes, and when they get too brittle due to the drawing, are given an annealing treatment in pots, following which they are drawn down to the final size, and only then put through the heat-treatment that gives them the desired mechanical properties. High grade material, however, is usually heat-treated at every stage where it is necessary. In certain cases it may prove advantageous to cement the rolled stock itself, in order to make greater reductions per draft. The practice of the individual plants as regards the reduction per draft, choice of lubricants and preparation for drawing differs quite considerably. One point which is, however, never lost sight of, is to prevent brittleness due to the pickling baths by the use of weak acid both when pickling and when drawing wet.

The rolled rods, which may have been annealed, cemented or patented, is pickled in sulfuric acid of from 12 to 22°Be. strength, washed if necessary, very thoroughly rinsed, limed and then dried in an oven for from 2 to 3 hours at a temperature of from 100 to 150°C. This will avoid any brittleness due to pickling. Fine wire, and such as has a carbon content of from 0.7% upwardly, is best pickled in hydrochloric (muriatic) acid solution, consisting of two-thirds water and one-third of the acid. The acid

Increase in Tensile strength of heat-treated steel wire due to drawing the same

Carbon-content ....%	1	0.90	0.85	0.75	0.65	0.60	0.55	0.50	0.45	0.40	0.35	0.30	0.25	0.20	0.15
Tensile strength of the heat-treated wire in kilograms per sq. mm.	150	140	130	120	105	100	95	90	85	80	75	70	67,5	65	60
Tensile strength of the drawn wire after two drafts corresponding to 50 to 55% diminuition in cross-section; in kilograms per sq. mm.	195	180	175	160	140	130	125	120	115	110	105	100	97,5	95	90
Same; after three drafts; corresponding to a 60 to 65% diminuition in cross-section, in kg. per sq. mm.	205	190	180	165	150	140	130	125	120	115	112	110	105	102	100
Same; after 4 drafts; corresponding to 70 to 75% diminution in cross-section; in kg. per sq. mm.	210	195	185	170	155	145	135	130	125	120	117	112	110	107	105

used for making up the bath is 20°Be. strength.

In order to be able to draw steel wires of exceptional brightness, and free from slivers, it is the practice to give the wire a coating of rust. This is accomplished by pouring slightly acidulated water, or just water, over the wire, and then allowing the rust to form. Such wire is called "Brown" wire, as compared to blued or heat-treated wire. Such wire is usually given a coating of "fat" lime, which is said to make the drawing of the same much easier.

Similar types of lubricants are used for the fine steel wires as are used for the corresponding iron wire. Wet drawing is not as often resorted to, as there is a decided tendency for the wire to rust under these conditions. For steel wire which is afterwards to be either galvanized or polished, and for preliminary drawing, the wet draft is very popular. The drawing speed varies. For large sizes of steel wire, the drawing-reels run from 12 to 35 r.p.m.; for medium wire from 40 to 50 r.p.m.; for fine wire about 60, and for very fine wire about 70 to 80. These figures are based for drawing-reels of the same diameter.

Within recent years some very useful drawing machines for steel wires have been brought into the market. These are distinguished for their careful choice of self-reduction draft, correct relation between the drawing speed for each reduction, for the cooling system which keeps the diamond-dies cool, and for the means adopted for throwing the machine in and out of motion without jerking.

The manufacture of steel wires for use in cables is about as follows:

As a general rule, the rolled rods, without any heat-treatment, are first drawn down from 5.5 mm. to 4.6 mm., or a little lower, and only then given a heat-treatment. Heavier wire can be drawn from three to five drafts without intermediate heating; although this depends somewhat upon the carbon-content. One firm, for example, produces a 2.6 mm. steel wire having a tensile strength of 140 kilograms, from 5.5 mm. to 4.6 mm.; gives it a heat-treatment, and then finishes the wire in four drafts. The size reduction

Layout of heat treating equipment. Wire passes from right to left.

in this case is from 4.6 mm. to 4.0, 3.4 to 3.0, to 2.6 mm.

To make 1.3 mm. wire, the same plant first makes a 4.6 mm. wire, heat-treats ,and then makes three drafts to bring it to 3mm., the steps being: 4.6, 4.0, 3.4, and 3.0 mm. Another heat treatment is then given, followed by five drafts to the final size (3.0, 2.5, 2.2, 1.85, 1.55, 1.3 mm.)

For wire as small as 0.8 mm., 4.6 mm. wire is first made, heat-treated and drawn down to 2.1 mm. in five drafts (4.6; 4.0; 3.4; 2.9; 2.5; 2.1 mm.) again treated and drawn to its final size in five more drafts (2.1; 1.7; 1.4; 1.15; 0.95; and finally 0.8 mm.)

For very high-grade cable wire, it is advisable to give at least three separate heat-treatments, especially for the finer sizes of wire. Information relative to the strength attained in the drawing of steel wire of the various carbon-content, is to be found in the table which is based upon a great many experiments.

These experiments are based upon data obtained with wires from 1.6 to 2.8 mm. diameter. as already mentioned, many wire-rope and cable works uses a material somewhat higher in carbon for the smaller sizes. One firm, for example, gives the following figures as being the most desirable:

Cable and wire-rope wire of a strength of 140 kilograms for square millimeter, for the smaller sizes should contain for 0.5 to 1.0 mm. dia. about 0.75% carbon.

For greater tensile strength the carbon should be still higher. For instance for a strength of 160 kilograms per square millimeter, the carbon content is 0.82%.

For tensile strengths from 180 to 200 kilograms per square millimeter the carbon content is 0.9%.

For instance, basing the calculations upon table 4, if 1.6 mm. dia. wire is to be made

(*Continued from page 243*)

A Wire Galvanizing Process

Treatment before zinc bath cleans surface thoroughly and results in perfect bond with base metal

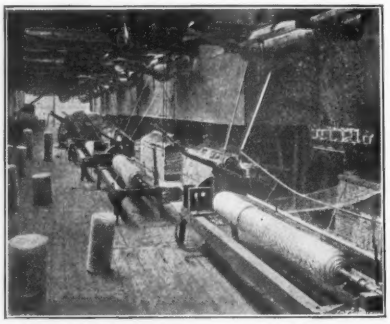
By Frederick M. Crapo

FOR more than a century, zinc has taken the first rank among metals to protect iron and steel from corrosion. Of the various methods for applying zinc coatings to iron base metals, the hot dip process is the oldest. Briefly, this consists of immersing chemically clean iron-base metal in a bath of molten zinc. The earliest known use of this process was about the middle of the Eighteenth Century when zinc was used in France to coat iron cooking utensils. Such articles dipped by hand, were given heavy and uneven coatings. It was learned, however, as the years passed, that these and other similar zinc coated products withstood protection for the iron and steel. Today the hot dip process consumes about 50 per cent of the world's supply of slab zinc. It might be well to consider more technical reasons why zinc is used so universally as protection for iron and steel.

Some years ago, the following demonstration was made to prove the electrolytic theory of corrosion: A strip of zinc and a piece of iron were placed in a weak solution of salt. It was noted that the iron corroded rapidly while the zinc was but slightly attacked. The usual explanation of this phenomenon is that zinc protects itself with an adherent film of zinc oxide or hydroxide, while the iron produces a non-adherent voluminous hydroxide, which does not protect. If, instead of being separated, the two strips of metal are placed in contact, the iron no longer corrodes but the zinc passes into solution.

Iron and zinc as two dissimilar metals form a galvanic couple of which zinc is the more electro-positive and protects the iron at its own expense. Clearly, this protection can persist only as long as a certain amount of zinc remains, which explains the necessity for uniform, continuous coatings.

In dry air, zinc retains its luster, but in damp air it becomes dull and frosted with a thin grayish-white of a basic carbonate which protects it from further oxidation. Zinc may be corroded appreciably in the presence of sulphur dioxide; hydrogen chloride promotes its atmospheric corrosion, owing to the hygroscopic character of zinc chloride. Impure zinc is dissolved readily by nitric, sulphuric, and sulphurous acids; also, by the caustic alkalies. Pure zinc is almost unaffected by acids, except nitric, and is oxidized by carbonic acid.



Wire netting emerging from the galvanizing bath in a British plant.

The zinc coating which is applied to iron and steel must fulfill a double function. First, it is designed to keep the surface of the coated metal from coming in contact with moisture and the atmosphere; second, to stand ever ready to enact the role of self sacrifice in the protection of the iron and steel whenever water and oxygen succeed finally in breaking through, and the day must arrive inevitably when even the best of zinc coatings will fail.

Continuous Method of Galvanizing

George Bedson of Manchester, England, invented the continuous method of annealing and galvanizing iron and steel wires by the hot dip process in 1860. Except for minor differences in technique, the method as described by Bedson is the one used most generally today. In making iron and steel wire, the wire is cold-drawn from coils of rod, which are hot rolled to the desired gauge from bars weighing usually about 300 pounds.

In galvanizing iron and steel wire which has been drawn to approximately the required gauge, it is first heated by passing continuously through a bath of molten lead, or through a refractory tube type furnace, in order to relieve the strains induced by the cold-drawing operation, and to insure the desired amount of ducility. It is then drawn through a pickle bath consisting of a dilute acid, usually hydrochloric, of suitable concentration and temperature, to make the surface perfectly clean and free from grease and oxide films, visible or invisible. The pickling is followed usually by passing the wire through a water rinse and thence through a fluxing bath. The wire is then dried and caused to travel through a bath of molten zinc. A flux is seldom used on the surface of the zinc bath; the surface at the point of entrance is covered usually with a layer of zinc oxide and skimmings.

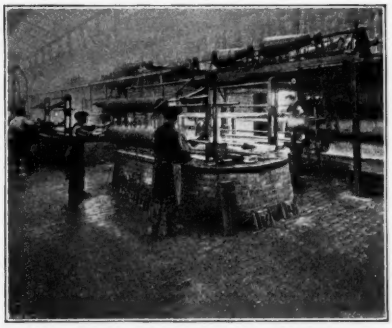
If, upon emerging from the molten spelter, the wire is wiped by running it through a tightly compressed material, usually oil soaked asbestos, the resulting coat is thin, contains

little or no pure zinc, and the wire is termed "single galvanized." If the wire instead passes through a thin layer of a suitable mixture of charcoal and oil, floating on the molten zinc, the product is then referred to as "double galvanized," a term often misinterpreted as meaning that the wire is dipped twice in the molten lead.

There is little or no wiping action from the thin layer of the charcoal mixture used in double galvanizing. It serves merely to keep the surface of the molten zinc free from the scum formed by oxidation which would tend to make the galvanizing rough if carried off the surface of the zinc by the wire. By using such a charcoal mixture and no wipe, and by varying the velocity of the wire, the temperature of the zinc, and the period of immersion, it is possible to apply uniformly smooth, heavy coatings of zinc to iron and steel wire.

Microscopic examination of such coatings reveals that the coating is composed of several layers. It is conceded generally by investigators, after a theoretical consideration based on the equilibrium diagram of the iron-zinc system, that these layers occur as follows: Beginning with the outside of the coating, the first layer is substantially pure zinc; second, there is a layer composed of Fe Zn_7 with varying amounts of zinc and iron in solid solution; next, a thin layer of an iron-zinc alloy corresponding in composition to the definite compound Fe Zn_3; and finally, the iron or steel base which, possibly, may hold some zinc in solid solution in its surface layer.

In molten zinc, the rate of solubility of iron and steel varies with the analysis and structure of the iron base metal. If a number of wires of the same diameter but different analyses, for example, ranging from ingot iron to high carbon steel, are galvanized under exactly the same conditions, the weight and structure of the coating on the several wires will vary considerably. The problem the galvanizer faces in zinc coating wire, to obtain the maximum protection against corrosion, is to apply a uniformly smooth, heavy coating. This must contain as large an amount of pure zinc as possible, with a minimum of deleterious element, so bonded to the base metal that the wire will withstand sharp bends and twists without the coating cracking and peeling off. As the base metal approaches pure iron, it becomes increasingly difficult to obtain such a coating.



Galvanizing wire netting in a British plant.

A New Process

Recent investigations have shown the primary cause of failure in zinc coatings, when subjected to bending or torsion strains, is the absence of a perfect mechanical bond between the iron base and the zinc coating. The problem of perfecting a strong bond between the underlying iron and an efficient heavy protective zinc coating has been solved only recently. This was accomplished in the research laboratory of the Indiana Steel and Wire Company, Muncie, Ind., and the process has been patented.

The essential difference between the old method of hot dip galvanizing and the new process, is the preliminary treatment of the surface to be galvanized in a bath of molten salts. These salts contain carburizing material, and are maintained at approximately 1350 degrees F. A few seconds treatment in this bath produces an advantageous action on the surface of the wire, cleaning it effectively, as well as leaving it in a different chemical condition. The surface, as prepared, is such that subsequent galvanizing results in the desired heavy coating with a thick outer layer of substantially pure zinc, and a perfect bond to the base metal.

In carrying out this new process commercially, the wire is run continuously through the molten salt bath, immediately following the annealing, but, as a matter of fact, the dip in the molten salts can be given to the wire at practically any stage in the process of manufacture from the rod to the finished wire.

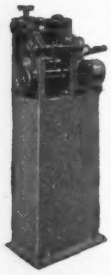
The salt treatment does not affect adversely the physical or electrical properties of the galvanized wire. The purest iron wire, galvanized by this process, may be wrapped around its own diameter without cracking or peeling. The electrical properties are excellent because the coating is made from the purest zinc it is possible to obtain commercially.

This new process is applicable especially to wire for various uses in the electrical and allied industries such as Extra Best Best (E. B. B.) and Best Best (B. B.) iron telephone and telegraph wire, mild steel wire, and seven wire strand. It is now possible to produce commercially, zinc coatings on all of these products with 0.8 to 1.0 ounce of zinc to the square foot of surface, with a maximum resistance to corrosion and excellent bending properties.*

According to the American Bureau of Metal Statistics, about 50 per cent of the total use of zinc in galvanizing in 1925 was for sheets. A little more than 20 per cent was used for tubes and the next largest consumption was for wire. In almost every branch of galvanizing there was a large increase in 1925 as compared with 1924.

*Presented at the meeting of the signal section, American Railway Association, at West Baden, Ind., September 29 to October 1, 1925 and reprinted from the Railway Review.

Some *of the* Master Tools *of the*
UNIVERSAL SPRING



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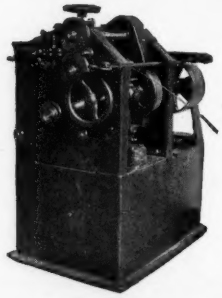

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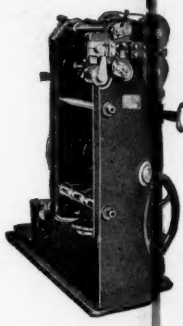

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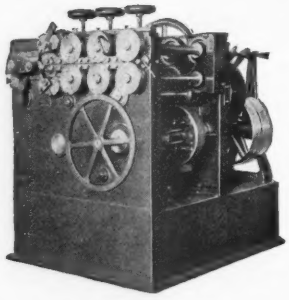

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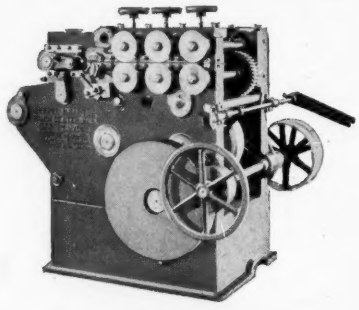

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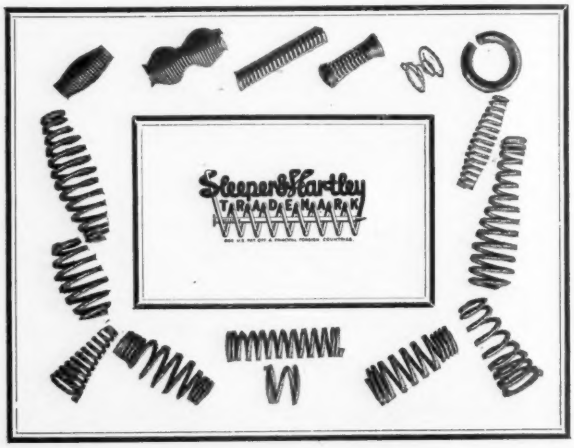

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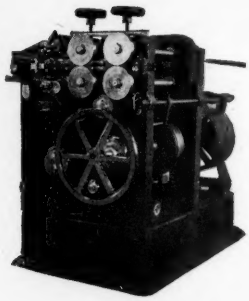

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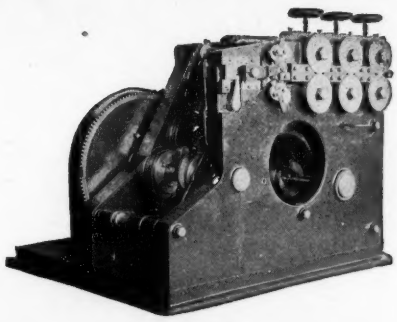

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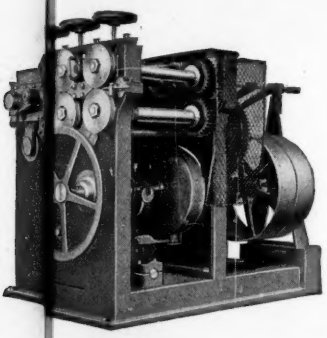

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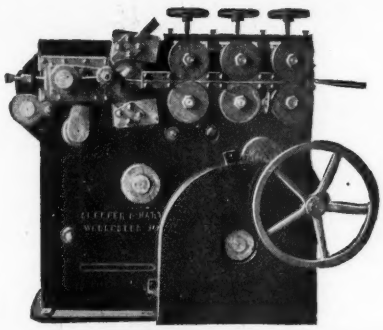

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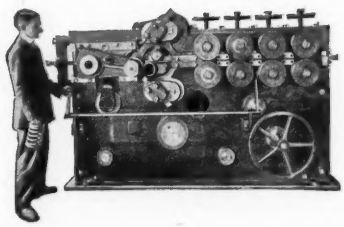

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& ARTLEY, Inc.
CESER, MASS.

ers Builders of
NG ND WIRE-WORKING
IACNERY

Why Hamper Your Skilled Men with Obsolete Equipment ?

EDITORIAL · IMPRESSIONS

Lower Wages or Higher Efficiency?

IS labor entitled to a share in the profits on capital goods? No! most manufacturers will say and this emphatic answer has given rise to rather complex and delicate problems in industrial management. In the wire industry in particular there is a notable instance of this difficulty. One large manufacturer of wire cloth employing a number of old style wire weaving looms pays his men at a piece rate set by the labor union. He could increase the efficiency of his plant and multiply his production if he replaced his old, out-dated, looms by more efficient types of modern manufacture. But these high speed machines will increase the output per man and consequently the wages, if the old piece rate is maintained. The union refuses to change the rate and the manufacturer does not want to pay the increased wages which the new machines would bring about. The result is the toleration of outworn types of machinery, with consequent waste in energy and a loss of opportunity of increasing production. Finally, the manufacturer feeling obliged to buy some of these new machines, is running them below full speed in order to keep wages low!

The difficulty rests in the principle of this sort of industrial practice: It is unfair for labor to derive profit from capital goods into which it made no investment.

In the instance under consideration, labor would gain by the new installations, *but the manufacturer would not lose.* The same piece rate means the same percentage of manufacturing cost expended on labor. The high speed machines mean a higher wage for the worker, and larger income—due to increased production and efficiency —for the owner. The owner invests his money in the new machines and gets the expected returns. Labor without investing also profits—incidentally.

At first glance it may seem that labor's profits from the machinery are unjustified. But since they involve no loss for the manufacturer in what sense are they unfair?

The present practice as illustrated in the instance we cite is essentially unsound and leads to a conflict between labor and capital that can work only harm to the industry, and in addition sets up an avoidable impediment to the improvement of manufacturing processes.

Protection

REPORT of the Anti-Dumping Bill pending action of Congress has reopened the age-old question of the protective tariff. This bill—initiated by the American manufacturers of pins and needles, who believe the successful German competition is made possible by the selling of German products below the manufacturing cost—aims to increase the present ad valorem duty to a point where the selling price of the imported goods will stand in more reasonable proportion to its supposed manufacturing cost.

A protective tariff, while often very salutary to industrial development, sometimes eliminates that impetus towards improvement that foreign competition offers.

Still Secretary Mellon's assertion that protection is necessary to American prosperity is not to be ignored. In his opinion our relatively high standard of living is made possible by the protective tariff against Europe and free trade over the very large area of our country.

We publish elsewhere in this issue an article by a noted German engineer on the manufacture of pins in Europe and particularly in Germany. We invite comment from American manufacturers in this field.

WIRE
& WIRE PRODUCTS

Five-Day Week

MR. FORD has again startled American industries with his recently inaugurated policy of a five-day week. What is most impressive is that this policy is to be permanently adopted in the Ford plants.

Some of our contemporaries have ventured to interpret this new policy as a sign of severe and successful competition offered to the Ford Motor Co., by other manufacturers in the same class. We dare say there is competition offered to Ford products but a reduction of hours of labor is not necessarily due to laxity in meeting this competition.

If increased efficiency in machine operations and methods at large, are to be of any benefit at all, they must ultimately lead to shorter working hours and less expenditure of human energy. The Ford plants seem to have reached this stage of efficiency.

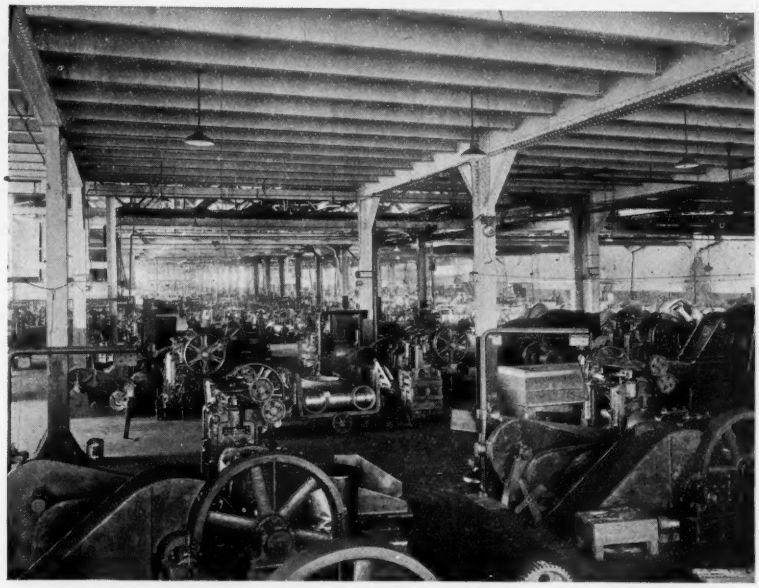
The shorter week is not due to reduced demand but to increased production. Let labor become more productive and the shorter working week is inevitable, unless, indeed, the other alternative of fewer hands is adopted. This latter Mr. Ford has wisely avoided.

There is also a larger economic reason for the five-day week wherever conditions in the industry permit.

Incresed productivity leading to shorter working hours necessarily results in increased volume of business.

VIEWS OF THE WIRE WORLD

At right: The flat wire mill of the Cuyahoga Works, American Steel and Wire Co., an excellent example of good illumination in factories.

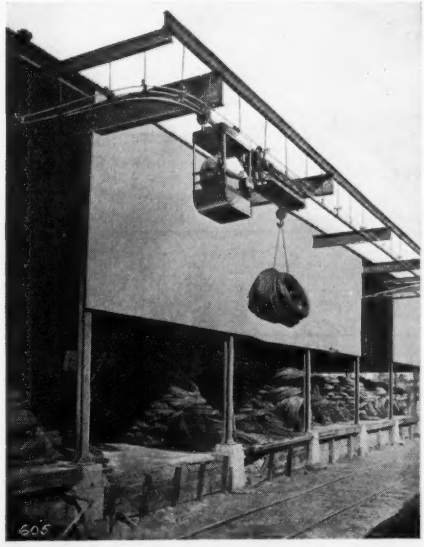


By Courtesy U. S. Steel Corp.

By Courtesy of Bureau of Safety, U. S. Steel Corp.

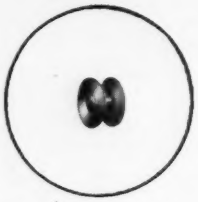
Above: A view of the galvanizing department of the Cuyahoga Works, Amer. Steel & Wire Co. Note the safety lever along side each block. If the operator's hand is caught while stripping the block, it strikes this lever and thereby stops the machine.

Below: An improved method of loading and unloading wire from railroad cars. The overhead rail forms continuous connection with the rest of the plant.



If you have photographs of interest to the Wire industry, send them to Wire & Wire Products

2½ INCHES *or* 8 FEET



"AMERICAN" Pressed Steel Reels and Spools are practically indestructible. More easily handled because they are *balanced.* Stronger and more rigid because of their unique design of pressed steel. *Always true to gauge* as specified — they are made with the same precise, honest workmanship as are "American" Belt Pulleys and Shaft Hangers.

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Manufacturers of Steel Split Transmission Pulleys, Pressed Steel Shaft Hangers, Pressed Steel Hand Trucks and Pressed Steel Shapes

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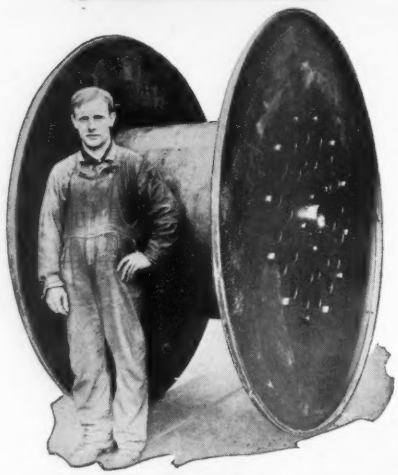

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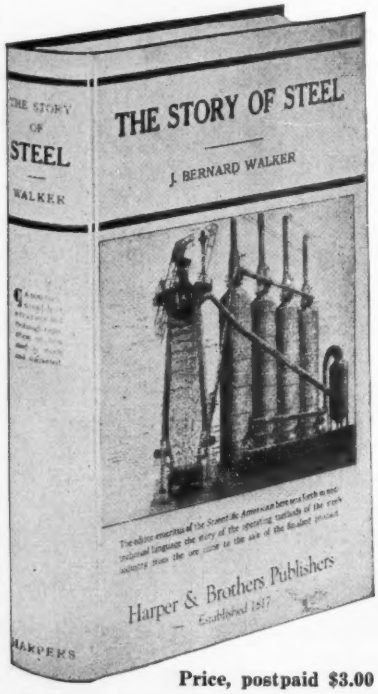

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Digest of Current Literature on Wire

Care Prolongs Wire Rope Life, by Walter Voigtlander, Iron Trade Review, 79:500-2, Aug. 26, '26.

The importance of skillful handling of rope for increased efficiency. The article treats proper methods of measuring wire rope; uncoiling and unreeling; splicing wire rope; seizing wire rope.

Lubrication of Materials Handling Equipment, Power Pl. Eng., 30:701, June 15, '26.

Along with the lubrication of gears, and bearings the article discusses the proper selection of lubricants for wire rope. The treatment includes the essential requirements of wire rope lubricants and in particular their proper viscosity with regard to the normal working temperatures. The application of the lubricant to the wire rope is also discussed.

Proper Method of Lubricating Wire Rope, Ind. Eng., 84:349, Aug. '26.

A very brief discussion of the requirements a good lubricant must meet.

Wire Rope Lubrications, by Allen F. Brewer, Ind. Management, 72:14-19, July, '26.

A detailed and illustrated treatment. The essential characteristics of a good lubricant are: 1. No tendency to gum, flake, cake or ball up. 2. No tendency to drip off, and must be resistant to thinning effect of high temperatures. 3. It should contain no acid, alkali or water. 4. It must resist evaporation and decomposition. 5. High adhesiveness and penetrative ability.

Wire Forming on a Punch Press, by R. H. Kasper, Mach. 33:52-3, Sept. '26.

An illustrated treatment of dies designed to replace a hand-operated wire bending fixture in order to increase production and secure more uniform results.

THE VAUGHN MOTOBLOC

PATENTS APPLIED FOR

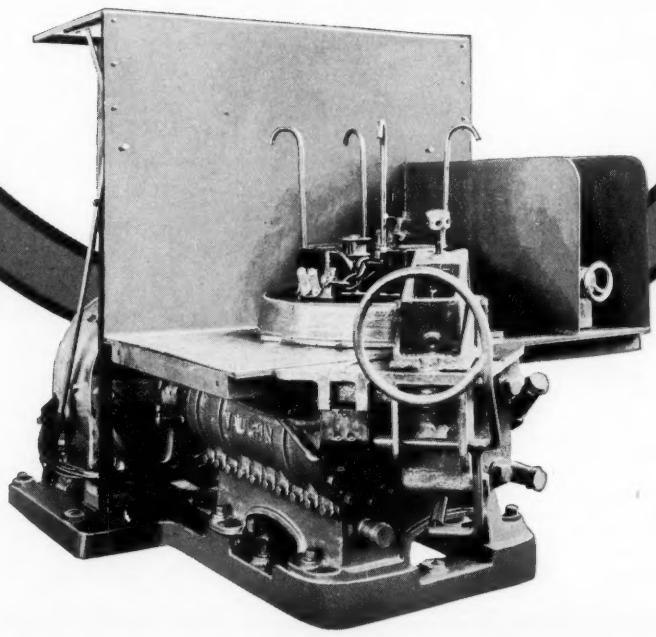
The VAUGHN MOTOBLOC has revolutionized all the accepted theories of wire drawing—we make this as a definite statement of fact.

Its flexibility, compactness—speed—production—its elimination of all the difficulties of the old block—has resulted in the full approval of this machine wherever used.

And, too, it's safe—the safety bar—the quick, positive stop—the ease of control—all make for satisfied, contented operators—which means better, faster work.

THE VAUGHN MACHINERY CO.

Cuyahoga Falls **Ohio**



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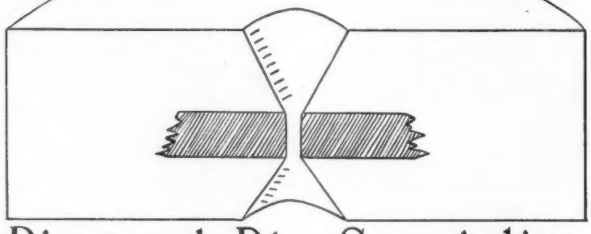
THE most important item in the drawing of wire, the diamond die, can now be sent to this specialist for necessary adustments and repairs.

We furnish a complete service on diamond dies, being equipped to do regrinding, polishing, shaping or any other of your requirements.

A staff of skilled technicians having many years experience assures you of expert work and a maximum of satisfaction.

Immediate and satisfactory service guaranteed.
Send us a package of dies today for a test.

John Leather



Diamond Die Specialist.

987 Watertown Ave.
WATERBURY, CONN.

NEWS OF THE INDUSTRY

THE American Steel & Wire Co., Worcester, Mass., has placed an order with the Westinghouse Electric & Mfg. Co., for one 3000 hp. motor, two 1500 kw. motor generators, 40 motors ranging from 2 to 200 hp. and control apparatus to cost approximately $225,000. The equipment is for its new Morgan Construction Co. wire drawing mill.

THE Central Steel & Wire Co., 5001 Bellevue Avenue, Detroit, has awarded a general contract without competition to the Henry B. Ryan Co., 510 North Dearborn Street, Chicago, for a one and two-story addition, 90x170 ft., to cost about $45,000. A portion of the structure will be used for storage and distributing service. W. S. Crosby, 6 North Michigan Avenue, Chicago, is architect. Harry R. Curran is president.

THE New England Butt Co., Providence, R. I., builder of braiding machinery and wire rope machinery, has opened a Chicago office at 140 Dearborn Stret, in charge of W. A. Richards.

GEORGE B. CAVERT, president and treasurer of Cavert Wire Co., Ellwood City, Pa., died Oct. 15, following an operation. He had been identified with the steel wire business since early manhood, and was a familiar and respected figure in the trade.

ELINAR TROILI, vice-president Udderholm Iron & Steel Co., Varmland, Sweden, was a recent visitor in Worcester, Mass. He inspected the North and South Works, American Steel & Wire Co. A score of years ago he was a draftsman at the Morgan Construction Co., Worcester, and also studied methods at the American Steel & Wire Co. plant. Mr. Troili will remain in this country until the end of this month.

Copies of
Wire & Wire Products

The publishers of this magazine will pay twenty-five cents each for copies of the May, June, and July issues.

Send copies to

Wire & Wire Products
461 Fourth Ave., N. Y. City

DOYLE DE COSTA MFG. CO., of Easton Pa., makers of electrical coil windings, has changed its name to Coilton Electric Mfg. Co. George B. Sherry of Easton, has succeeded Wm. L. Doyle as President and is pushing an expansion program which will double the plant's capacity.

FRANK B. Ungar has been appointed assistant to the general manager of sales of the Ludlow-Saylor Wire Co., St. Louis, manufacturer of wire cloth and woven wire screens He has been connected with the company's sales department for 26 years and prior to his recent advancement was Chicago representative.

THE Niagara Wire Weaving Co., Niagara Falls, Ont., will build an addition 110 x 120 ft., which will be equipped to manufacture wire cloth screen 270 in. in width for the paper mills of Canada.

THE Central Spring Co., Oshawa, Ont., has started work on an addition to its plant and will purchase additional machinery.

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None Better!

PRODUCTION in QUANTITY
PERMITS
LOW PRICES for QUANTITY

FOR FULL PARTICULARS WRITE TO

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WET OR DRY TYPES

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SOLE U. S. AGENTS
FOR GENERAL ENGINEERING CO.'S EJECTAIRE AND VACUUM EQUIPMENT
FOR WIRE INSULATING PLANTS

The Manufacture of Iron and Steel Wire in Germany

(*Continued from page 231*)

from rod containing 0.85% carbon, the final strength of the wire to be 180 kilograms per square millimeter, this could be done in three drafts with heat-treated wire, with a 65% reduction in diameter per draft. 1.6 mm. dia. wire has a cross sectional area of 2.01 square millimeters. This requires a preliminary wire of 5.74 sq. mm. cross-sectional area, which would correspond to a diameter of 2.7 mm. This 2.7 mm. dia. wire would have to be made in three drafts from 4.4 mm. dia. wire, and this in turn should have originated from 5.5 m. dia. rod, and have cemented at the 4.4 mm. dia. stage.

Spring-wire of ordinary commercial grade, unless a specially good material is required, is usually made from Siemens-Martin (open hearth) or from basic open-hearth steel, having a carbon-content of about 0.15%. This is usually given a preliminary hardening in water.

The manufacture of galvanized or polished spring-wire for the fabrication of patent matresses and bed-springs is made from a material containing about 0.55%C, in from 2 to 4 drafts from patented wire which is usually galvanized after drawing and then given a very light draft of from 0.2 to 0.3 to polish the wire. By far the greater amount of all commercial steel spring-wire is made from a readily hardened steel containing 0.6% carbon. The hardening of the wire can either precede, or follow the manufacture of the springs. The various degrees of hardness of drawn steel wire will be taken up further on. Wire for very high-grade springs is made in about the same way as piano-wire.

For piano wire and specially good spring wire, it is usual to take Swedish steel containing from 0.7 to 1.1%C. In making wire from 1.6 to 0.8 mm. diam-

(*Continued on page 249*)

Continuous Wire Drawing Machines

Spooling attachments

Multiple head spoolers

Draw frames and rolling mills

Any and all modern equipment for the wire mill.

CYRUS CURRIER & SONS

NEWARK, N. J.
365 Market St.

Continuous Wire Drawing Machine

A light, compact, and inexpensive machine of the ball bearing type, for rapid and economical production of fine wire.

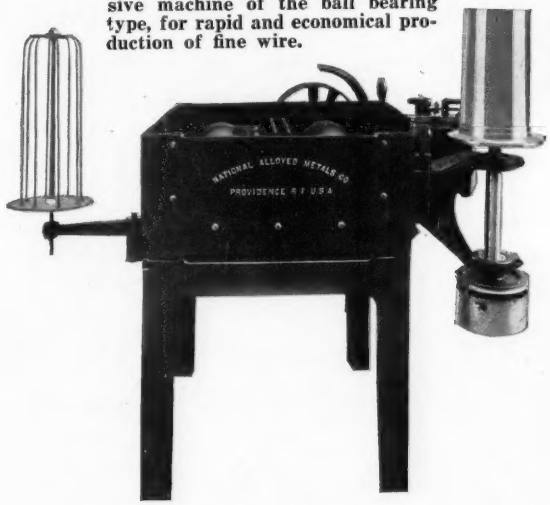

Illustration features No. 2 Machine. Capacity No. .20 B & S to .003.
We will furnish information on other sizes.

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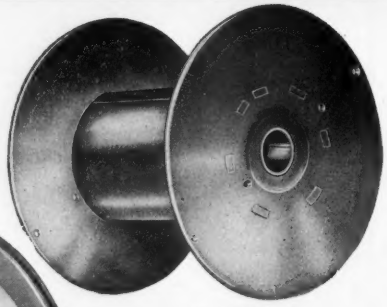
Specializing in the Manufacturing of REELS & SPOOLS of all sizes.



For Annealing and Handling Fine Wire

We solicit your inquiries

For Use in Vulcanizing and Impregnating Wire (Pat. Pending)

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ROTARY WIRE STRAIGHTENING AND CUTTING MACHINES

FULL AUTOMATIC

Equipped with flying shear allowing uninterrupted feed of wire through the machine.

Guaranteed not to mark or swell wire in spots.

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HALLDEN MACHINE CO.

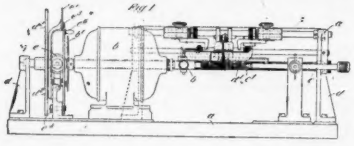
Thomaston, Conn.

Review of Recent Patents

Conducted by
Eugene Grunstein

Coil Winding Machine

The invention relates to a coil winding machine which automatically stops working when a predetermined length of wire has been wound on the bobbin.



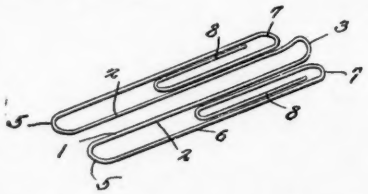
A variable drive mechanism is provided to permit of variation of the speed of reciprocation of the transverse arm relatively to the speed of rotation of the bobbin to be wound, so that wires of different thickness can be wound with their convolutions close together.

U. S. Patent 1,592,375.

Some New Designs in Wire Products

Clips

Another variety of paper clip, more elaborate than the usual gem clip, but not without its advantages.



U. S. Patent 1,600,748 issued to Eugene Bader, Cincinnati, Ohio.

Hairpins

U. S. Patent 1,594,871 issued to J. E. Badger et al. assignors to Textile Products Co., Detroit, Mich.

Auto Robe Cable

A flexible wire cable is covered in this invention with

tubular fabric linings braided over the cable.

U. S. Patent 1,596,707 issued to Daniel Bartlett, El Reno, Okla., assigner to C. R. Bending, Phila. Pa.

Annealing Wire in Salt Baths

(*Continued from page 225*)

ing out some ideas that these authorities claim to be entirely impractical. The combination of furnace, bath material and annealing problems all had to be considered from the standpoint of their interdependence.

Above, we referred to the very interesting metallurgical conclusion that the vital factor in annealing was the definite uniform temperature attained by the work. Experience with a number of grades of material has confirmed this conclusion, which from a technical standpoint is the most radical feature of the process. Before going into the practical results as they effect plant organizations, and costs, the technical considerations of this feature will be outlined briefly as the actual benefit of the process are so largely dependent on the recognition of this feature. In developing cycles for annealing steel of carbon content varying from razor blade steel analysis to "Armco iron" the metallurgists most familiar with these methods have invariably insisted that the time at the peak of temperature or the rate of cooling were the essential factors to get the best anneal, or, to get the required Brinell number. In consequence hundreds of tests have been made varying the times at the right heat and the rates of cooling, but no conditions have been found where these factors make any great difference, provided a best anneal temperature (plus or minus ten degrees) is obtained. We believe that the foundation for many of these fallacious

"What is the WEAK SPOT in Annealing?"

"Personnel?"

"No!"

"Facilities?"

"No!"

"What, then?"

"OBSOLETE METHODS!"

OBSOLETE methods cost money in the plant that relaxes a constant vigilance.

When a furnace manufacturer relates of saving $2.58 on fuel cost per ton of metal annealed you can make up your mind that there is "Something rotten in Denmark," for this **"saving"** is **four times** as much as the cost should have been.

The cost for fuel per ton of metal annealed should not exceed $.60 (sixty cents). It is, therefore, incompatible with modern methods to effect a **saving** of $2.58. Only by comparison with methods long obsolete could such a **"saving"** be effected.

If you will advise us of the kind and volume of annealing you do, we will show you some facts and figures that will convince you of the merits and economy of the **Bellis Lavite Process** for **Annealing.**

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Metal Spools for Wire Drawing

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Metal Lined Spools for Shipping

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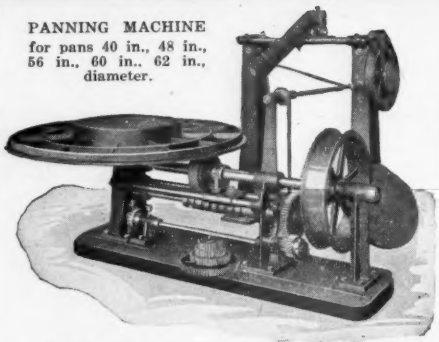
PANNING MACHINE
for pans 40 in., 48 in., 56 in., 60 in., 62 in., diameter.



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Patented
Panning Machine
automatically places rubber covered wire in sheet metal pans for vulcanization. SAVES WAGES OF AN OPERATOR and INCREASES PRODUCTION SPEED of Tubing Machine 25% to 50%.

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Wire Drawing Soaps and Compounds

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For High or Low Carbon Wire

Working Samples sent on request.

Established 21 years.

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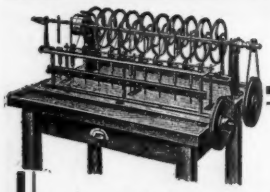

"POHENKRA" WIRE DIE POLISHING MACHINE

Indispensable For All Kinds of Wire-drawing

U. S. Patents
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1039186—1912
England 16171
1910
France 420503
Germany 226062
Austria 46339

Gives an absolute guarantee of grinding the diamond holes perfectly round, a result hard to accomplish with all devices employed before.

Simultaneously grinds the entire wall of the draw stone, including the inlet and outlet.

Ten times more effective than previous devices; one workman unassisted can polish 30 diamonds simultanously.

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Forms Eleven Sizes of Eyes from Round, Square, Flat or Half-Round Stock, also almost any shape desired Quickly and Efficiently.

Adjustable for No. 3 to No. 24 Gage Wire.

The cut on the left shows a few of the thousands of the forms made on this

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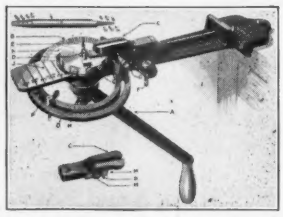

Patented April 2, 1918

M. D. Kilmer & Co.

Cleveland, Ohio, U. S. A.
Box 237, Station B.

treatments is that it is physically impossible to establish the best temperature for annealing a mass such as a coil of wire and bring it to heat in the short time in an air or gaseous medium, or even when packed in solids, without over-heating, or heat-heating for relatively too long a time, the outer strands of the coil. Experiments with thermal couples with different types of protection tubes have shown that the variation of times of heating of the outer strands and center of the mass may vary several hundred per cent., and it is well known that the time at the high heat is often stretched out to several days in the ordinary pack annealing process. We believe this is done solely to avoid an excessive temperature in the outer coils which would result if a greater temperature gradient were used in the furnace to overcome the low heat conductivity of the solid or gaseous heating medium.

Another important line of evidence on this point is the comparison of the drawing qualities of the annealed wire. It has been the usual experience that the wire draws better after the bath annealing, even though not showing any particular difference under the Brinnell or Rockwell tests. The conclusion of the men who draw the wire is that a more uniform and more consistent structure results from the liquid annealing process.

The practical results of the process are evident from the foregoing. A better anneal is obtained at a great saving of time, money and floor space. The process substitutes an hour's annealing allowance for two day's tieup of the material in the pot furnace and pickling room. Where fine tool steel was being annealed with careful cost record showing $5.00 for the annealing in the bath the former cost of the pack annealing was $20 to $25.00, though the latter method was most efficiently carried out. This advantage is of course not so great where cheap-

er material is being handled and less care was given in the old practice, but it can be demonstrated that the method requires less fuel, less handling, and less pot cost per unit annealed than the old methods, and that these economies are inherent in the method. It is also evident that a furnace of this character and heating so intensively requires much less space, and that the storage, pickling and washing are minimized, so that a much quicker turnover is possible. To be able to draw from hot rods to needle wire in one day with two anneals seems marvelous in a plant used to promising five days for minimum delivery. These several advantages have different weights as requirements of plants vary. In some the cost is the prime consideration, in others the quicker turnover is important, while in others quality is the chief consideration.

Liquid bath annealing processes promise important developments, which will considerably extend the general usefulness of wire and wire products.

Pin Manufacture in Europe

(*Continued from page 228*)

After leaving the machine the pins go through a special treating process depending on the type of metal used. The steel pins are first hardened by heating in a special furnace to a certain temperature and putting them afterward into cold oil. Then the pins are given the desired degree of elasticity by dipping same into hot oil. After this process the pins are washed and then polished in revolving drums. Better qualities are nickel-plated which is done by means of the simple dipping process. Iron pins are, after coming from the machine, washed and tinned and sometimes nickel-plated.

Brass pins are boiled for a half-hour in tartar solution or treated with diluted sulphuric acid, or they are treated in a re-

PIN MACHINES for the manufacture of Pins, Safety Pins and Hair Pins.

NEEDLE MACHINES for the manufacture of Sewing Needles and Sewing Machine Needles.

AUTOMATIC POINT GRINDING MACHINES
for tapering various wire articles as pins, needles, ice picks, etc.

MACHINES FOR
Bolts and Rivets
Gem Clips
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Wire Drawing
Wire Nails
Wire Staples
Wire Winding
Wire Weaving

The "Superior" Wire Drawing Machine

The ultimate in a compact and inexpensive machine.

One man efficiently operates 6 of these machines simultaneously.

6 Draft Wet type. Capacity .032" to .004".

Floor Space 39"x54"

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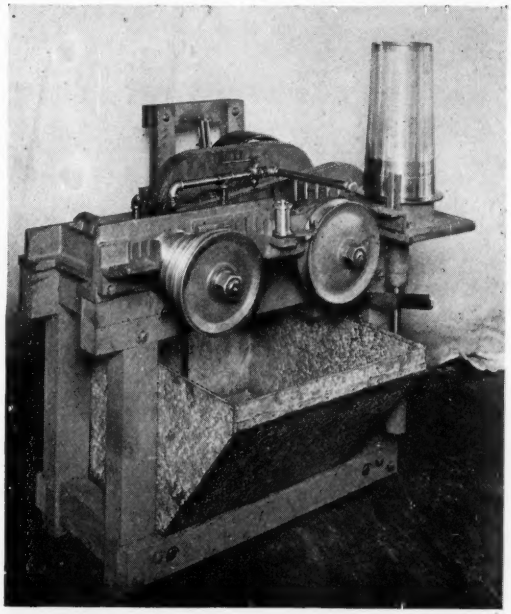

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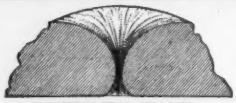

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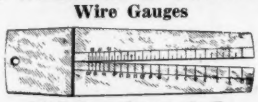

7607 Broadway, S. E.
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Wire Mill and Cold Rolling Equipment
10255 Harvard Ave.
CLEVELAND, OHIO

Manufacture of Wire in Germany

(*Continued from page 243*)

eter and less, the wire, after patenting, is drawn from No. 39 to 20 with fat lubrication, and from 17 on is drawn wet. No intermediate heat-treatment is required.

Finished piano-wire must show a tensile strength of from 250 to 380 kilograms per square millimeter, and yet be so tough that it can be hammered completely flat without breaking, and be capable of being wound around itself without danger, a test which every wire-drawer making such wire must make right on the spot.

Statement of ownership, management, circulation, etc., required by the Act of Congress of August 24, 1912, of Wire & Wire Products published monthly at Washington, N. J., for October 1, 1926.

State of New York, County of New York. ss.: Before me, a Notary Public in and for the state and county aforesaid, personally appeared Sylvan Hoffman, who, having been duly sworn according to law, deposes and says that he is the publisher of the Wire & Wire Products and that the following is, to the best of his knowledge and belief, a true statement of the ownership, management, etc., of the aforesaid publication for the date shown in the above caption, required by the Act of August 24, 1912, embodied in section 411, Postal Laws and Regulations, printed on the reverse of this form, to wit:

1. That the names and addresses of the publisher, editor, managing editor, and business managers are:

Publisher, Sylvan Hoffman, 416 Fourth Avenue, New York City; editor, William Grunstein, 461 Fourth Avenue, New York City; business manager, Harry Schwartzschild, 461 Fourth Avenue, New York City.

2. That the owner is: (If owned by a corporation, its name and address must be stated and also immediately thereunder the names and addresses of stockholders owning or holding one per cent or more of total amount of stock. If not owned by a corporation, the names and addresses of the individual owners must be given. If owned by a firm, company, or other unincorporated concern, its name and address, as well as those of each individual member, must be given.) Neckwear Publishing Co., Sylvan Hoffman, Della Hoffman, Mary Greenberg, Harry Schwartzschild, all of 461 Fourth Avenue, New York City, N. Y.

3. That the known bondholders, mortgagees, and other security holders owning or holding one per cent of total amount of bonds, mortgages, or other securities are: (If there are none, so state.) None.

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SYLVAN HOFFMAN,
(Signature of Publisher)

Sworn and subscribed before me this 21st day of October, 1926.

(SEAL) ARTHUR V. MOORE,
Notary Public.

My commission expires March 30, 1928.

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For drawing all kinds of wire

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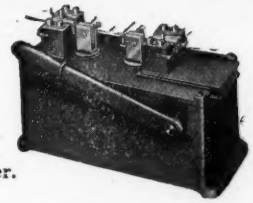
Standard Electric Wire Pointer



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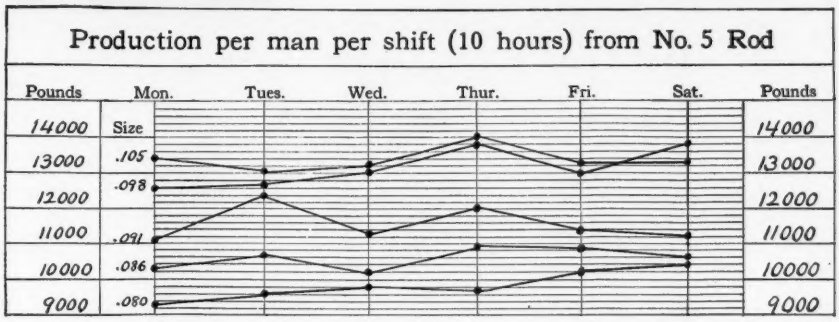

High Output per Man
is the outstanding characteristic of the
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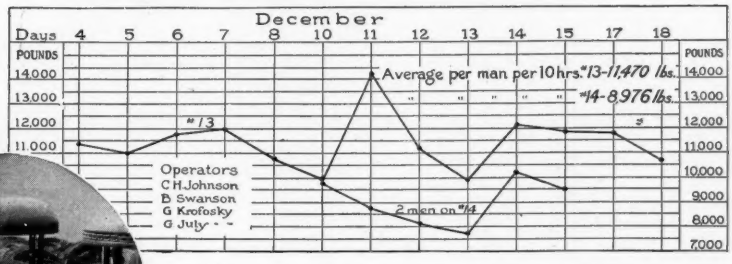

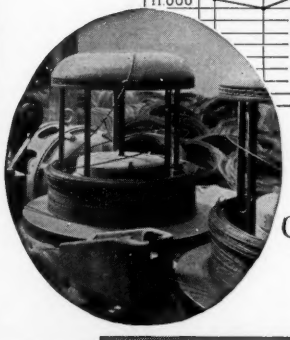

The chart above gives in the form of a composite curve the average output per man per day of four operators running eight machines at the Portsmouth Ohio Plant of the Wheeling Steel Corporation.

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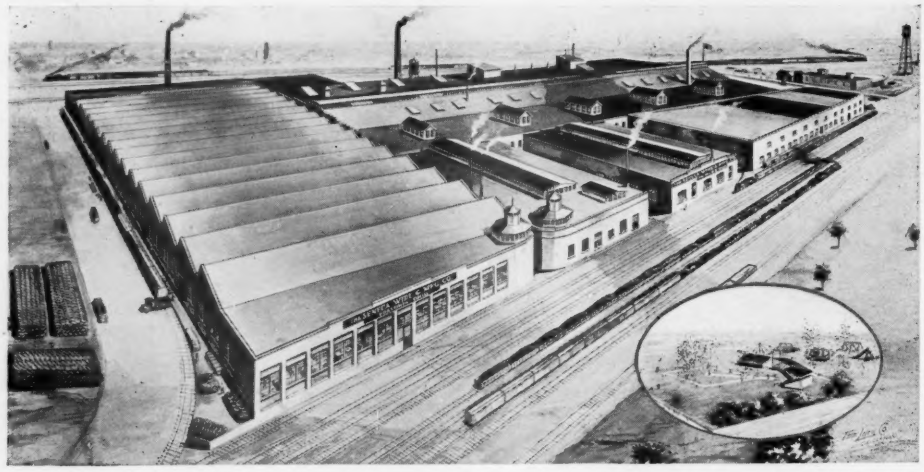

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